What is claimed is:

1. A pocess for making a hard pellicle for a photomask, comprising the following steps:

(i) providing a silicon wafer having a substantially flat surface;

(ii) forming an ion-implanted layer adjacent to the flat surface of the silicon wafer;

(iii) depositing a pellicle layer having a first surface and a second surface on the surface of the ion-implanted layer, with the first surface bonding to the surface of the ion-implanted layer, and the second surface opposite to the first surface;

(iv) bonding a pellicle mount frame to the second surface of the pellicle layer; and

(v) separating the pellicle layer and a portion of the ion-implanted layer from the silicon wafer at a location within the ion-implanted layer by heat treatment.

2. A process in accordance with claim 1, wherein in step (ii), the ion-implanted layer is formed by hydrogen, helium and/or fluorine ion implantation, and the separation in step (v) is carried out by thermal annealing.

3. A process in accordance with claim 1, wherein in step (iii), the pellicle layer consists essentially of a material selected from silica, fluorine doped silica, aluminum doped silica, methylated silica, fluorinated and methylated silica, fluorinated aluminum doped silica, CaF_2, MgF_2, BaF_2 and SiC.

4. A process in accordance with claim 1, wherein in step (iii), the pellicle layer is deposited via chemical vapor deposition and/or plasma vapor deposition, or sol-gel process.

5. A process in accordance with claim 4, wherein in step (iii), the pellicle layer is deposited via a process selected from plasma enhanced chemical vapor deposition (PECVD), low pressure chemical vapor deposition (LPCVD), sub-atmospheric chemical vapor deposition (SACVD), ion-assisted e-beam evaporation, non ion-assisted e-beam evaporation and sputtering.

6. A process in accordance with claim 4, wherein in step (iii), the pellicle layer is deposited via plasma enhanced chemical vapor deposition (PECVD).

7. A process in accordance with claim 1, wherein in step (iv), the bonding between the pellicle layer and the pellicle mount frame is effected by wafer bonding.

8. A process in accordance with claim 7, wherein the bonding is effected by anodic bonding, low-temperature bonding or fusion bonding.

9. A process in accordance with claim 1, wherein in step (iv), the bonding between the pellicle layer and the pellicle mount frame is effected by using frit.

10. A process in accordance with claim 1, wherein in step (iv), the pellicle mount frame consists essentially of a material having substantially the same coefficient of thermal expansion as that of the pellicle layer.

11. A process in accordance with claim 1, wherein in step (iv), the pellicle mount frame consists essentially of silica.

12. A process in accordance with claim 10, wherein the pellicle mount frame is porous and allows for the passage of purging gas used during the lithographic process.

13. A process in accordance with claim 1, further comprising either a further step (vi) as follows:

(vi) removing the residual silicon material from the ion-implanted layer on top of the first surface of the pellicle layer;

or a step (vii) as follows:

(vii) converting the residual silicon material from the ion-implanted layer on top of the first surface of the pellicle layer to a material compatible with the pellicle layer.

14. A process in accordance with claim 13, wherein step (vi) is carried out, and plasma etching is used to remove the residual silicon.

15. A process in accordance with claim 13, wherein step (vii) is carried out, and thermal oxidation is used to convert the residual silicon to silica.

16. A process in accordance with claim 1, further comprising the following step (viii) after step (v):

(viii) forming an antireflective coating on at least the pellicle surface opposite to the pellicle mount frame.

17. A process in accordance with claim 13, further comprising the following step (viii) after step (vi) or (vii):

(viii) forming an antireflective coating on at least the pellicle surface opposite to the pellicle mount frame.

18. A hard pellicle comprising a hard pellicle layer having a first surface and a second surface, a thickness ranging from about 5-120 μm, a high transmission and a high laser stability at the lithographic wavelength, and a pellicle mount frame attached to the peripheral area of the second surface of the pellicle layer.

19. A hard pellicle in accordance with claim 18, wherein the pellicle mount frame has substantially the same coefficient of thermal expansion of that of the pellicle layer.

20. A hard pellicle in accordance with claim 18, wherein the pellicle layer consists essentially of a material selected from silica, fluorine doped silica, aluminum doped silica, methylated silica, fluorinated and methylated silica, fluorinated aluminum doped silica, CaF_2, MgF_2, BaF_2 and SiC.

21. A hard pellicle in accordance with claim 18, wherein the pellicle mount frame is porous and allows for the passage of the purging gas used during the lithographic process.

22. A hard pellicle in accordance with claim 21, wherein the pellicle mount frame consists essentially of porous silica.

23. A hard pellicle in accordance with claim 19, wherein at least one surface of the pellicle layer is coated with an antireflective coating.